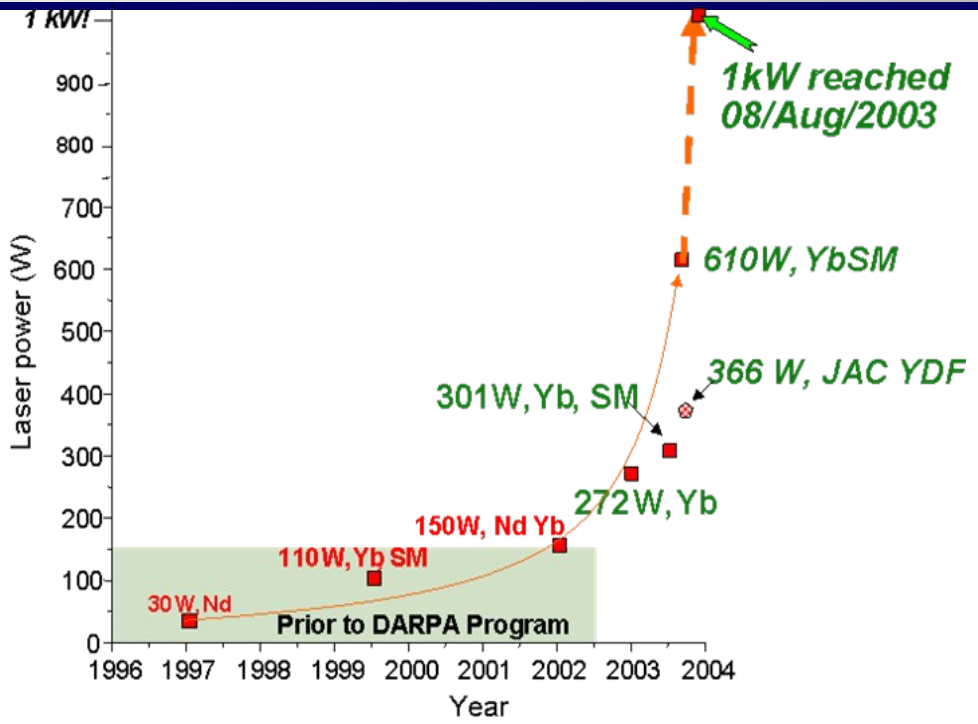
HPFL
High Power Fiber Lasers

Program Objective:

- Increase the output power for single-mode fiber lasers
- Develop robust, compact, power-efficient architectures for high-power fiber lasers

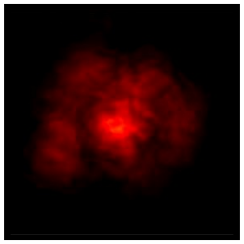
Technical Challenges:

- Mode and polarization preservation in fibers at high power density
- Coherent combination of lasers yielding high beam quality at ~100kW

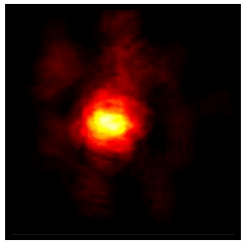


Program Status:

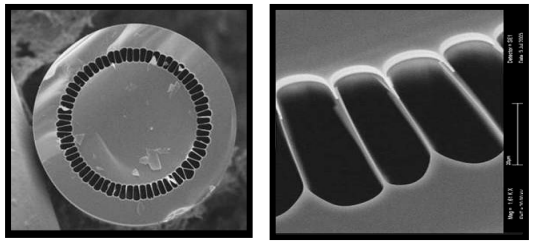
- Demonstrated single-mode output of 1.4 kW from a single fiber
- Demonstrated coherent combination of multi-fiber array by self-organization



Far-field of fiber-laser bundle without coherence



Far-field with coherence

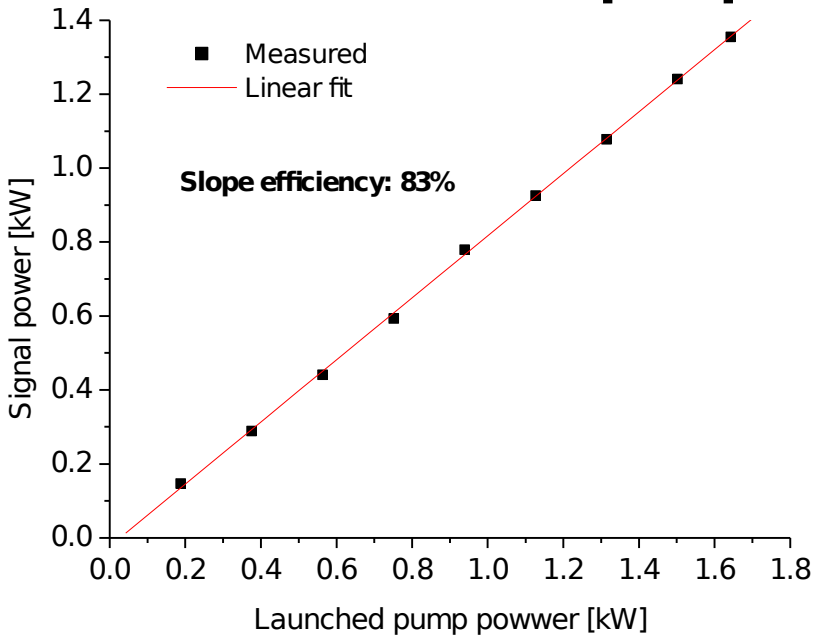


High-Power Single-Mode Fiber Laser with Air Cladding

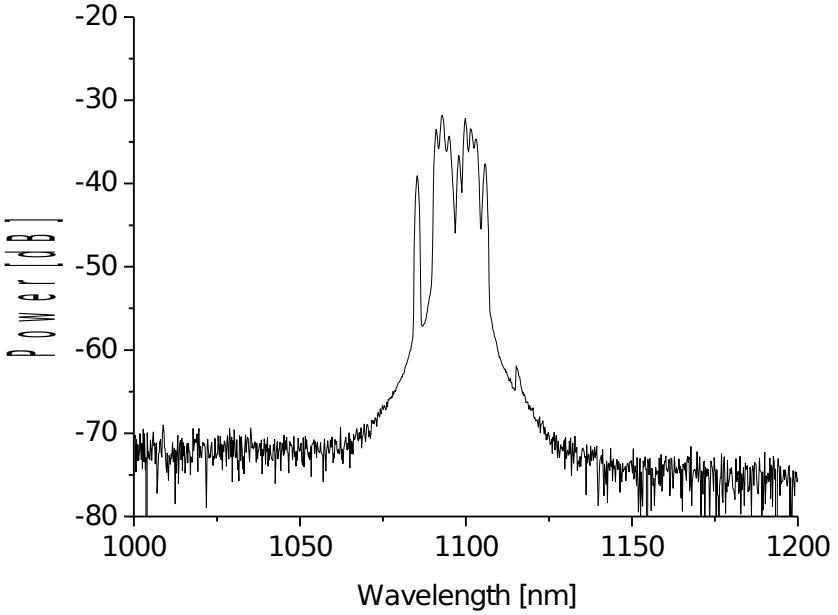
proved for Public Release, Distribution Unlimited, Case #3586

Yb-doped fiber laser with 1.36 kW continuous-wave output power

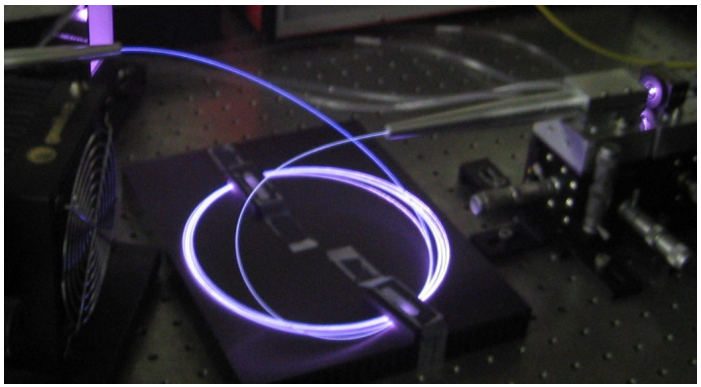
Fiber laser output power



Output spectrum at full pow



- **No wave front aberrations in the gain region**
- **Efficient conversion launched diode power ~ 80%**
- **Large surface to volume ratio for efficient thermal management, heat dissipation ~ 1.5 watts /cm²**
- **Potential for 10 kilowatt high power fiber lasers**



proved

86 W, 1552 nm, Single-frequency Erbium-Ytterbium Doped Fiber Amplifier Chain

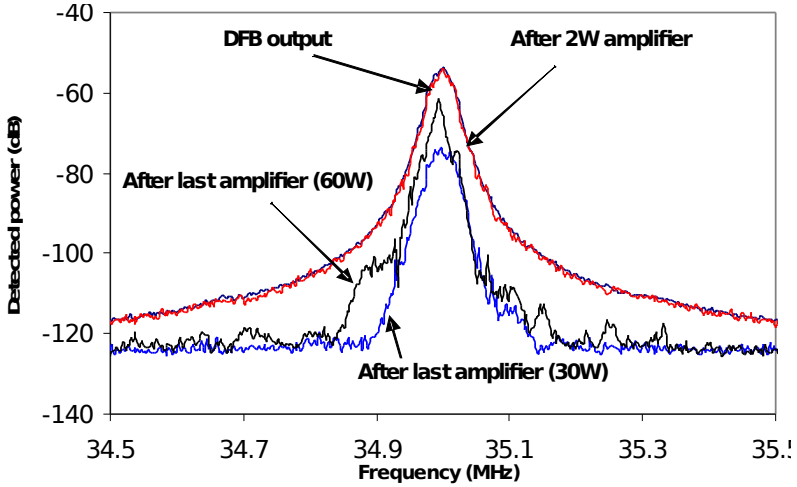
High-power single-frequency (~20 kHz)

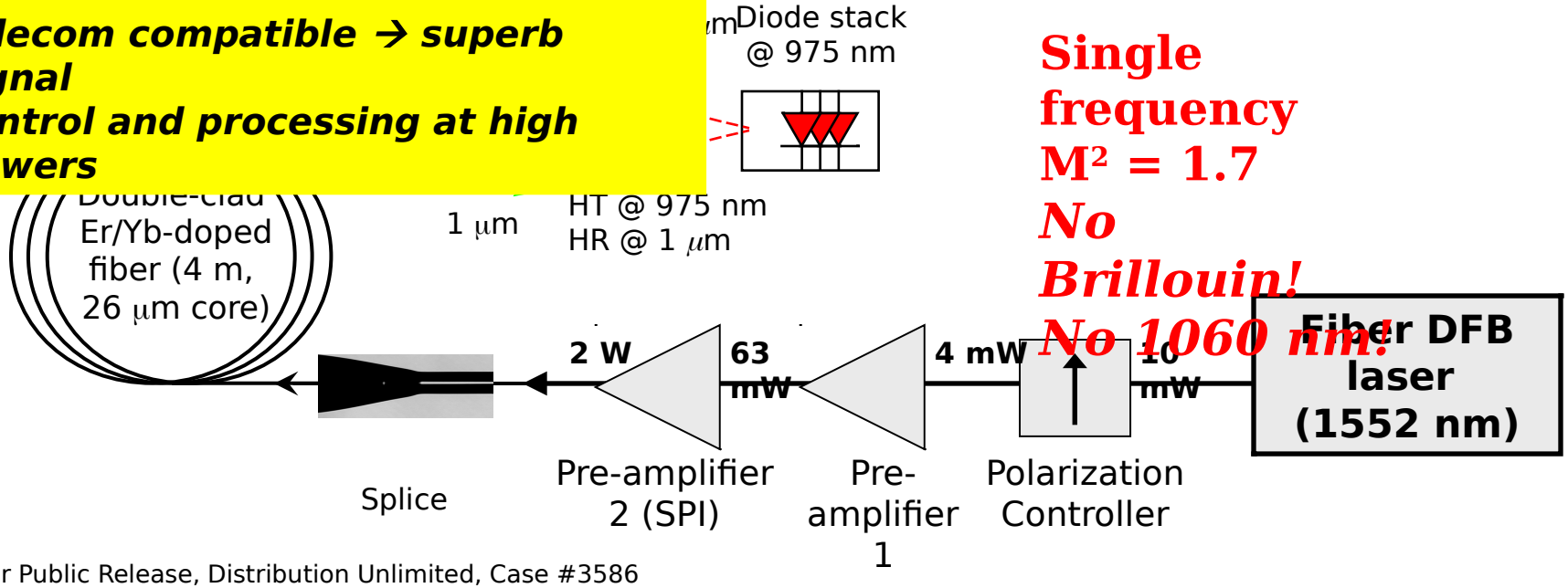
"Eye-safe" wavelength

Collateral damage from indirect viewing reduced by five orders of magnitude

Significantly enhanced training value due to eye-safety requirements

Telecom compatible → superb signal control and processing at high powers





Single frequency
M^2 = 1.7
No Brillouin!
No 1060 nm!

proved for Public Release, Distribution Unlimited, Case #3586